



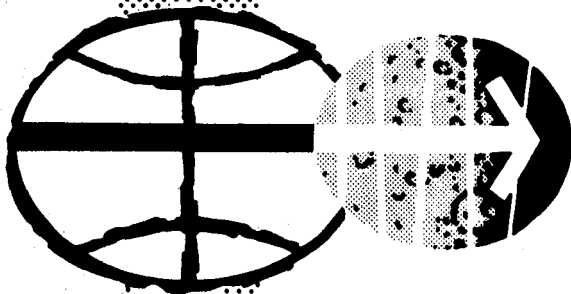
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

**A COMPARATIVE ANALYSIS OF THE PROFESSIONAL'S
OCCUPATIONAL ENVIRONMENT AT THE
MANNED SPACECRAFT CENTER**

(MSC-BM-MR-69-2) A COMPARATIVE ANALYSIS
OF THE PROFESSIONAL'S OCCUPATIONAL
ENVIRONMENT AT THE MANNED SPACECRAFT
CENTER (NASA) 60 p

X73-77438

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**MANNED SPACECRAFT CENTER
HOUSTON, TEXAS**

JANUARY 1969

A COMPARATIVE ANALYSIS OF THE PROFESSIONAL'S
OCCUPATIONAL ENVIRONMENT AT THE
MANNED SPACECRAFT CENTER

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

January 1969

FOREWARD

This study was undertaken as part of the Resident Research Fellowship Program co-sponsored by the Manned Spacecraft Center and eight participating universities. Mr. Hamilton was a student in the School of Public Administration, University of Southern California. This report is a summary of Mr. Hamilton's dissertation which was submitted to USC as partial fulfillment of the requirements for the Doctor of Philosophy Degree. The Resident Research Fellowship Program is designed to provide university graduate students with the opportunity to broaden their experience and conduct research in an actual R&D organization.

William N. Henderson
Director, University Programs
Office

ACKNOWLEDGEMENT

This report is a result of the author's Ph.D. dissertation at the University of Southern California, which was written under the auspices of the Graduate Resident Research Fellowship Program at the Manned Spacecraft Center, Houston, Texas. The author appreciates the time and support given to him by all of those involved in this study. A special note of thanks is due Mr. E. O'Brian Smith and Mrs. Ruth Ann Barton for their assistance.

The author wishes to particularly express his appreciation for the support facilities and guidance received from Mr. Earle Young's management analysis staff.

ABSTRACT

This study was a comparative analysis of the work environments of nonsupervisory Aerospace Technologists (AST's) at the Manned Spacecraft Center in Houston, Texas. Specifically, it focused on the attitudes or perceptions that nonsupervisory AST's have toward their organization and position in the following Directorates: Engineering and Development; Flight Operations; Science and Applications; and Flight Crew Operations.

A questionnaire mail-out and follow-up interviews were the primary data collection instruments. From a personnel list, 282 AST's were randomly selected. The number of questionnaires returned was 166 or 59 percent. In a methodological sense, 59 percent was considered inferentially adequate.

The questionnaire responses were coded, and a FORTRAN program was subsequently written for a UNIVAC 1108 computer. From an analysis of the computer printouts, the following results were derived:

1. The background and experience data reflect the homogeneous nature of the study's sample. This finding would preclude the report attributing any unusual variations in the results to this factor.
2. In general, the nonsupervisory ASTs' attitudes or perceptions toward their organization is favorable. A consultative-participative management style emerged.
3. Concerning their position in the organization, most of the participants were satisfied with the nature of their work at the Center.

Job tension was not excessive, and the number of AST's reporting that they were unclear or ambiguous about their duties and responsibilities was relatively low. Computer analysis revealed significant measures of association or relationship between job ambiguity or uncertainty, tension and job satisfaction. Accordingly, it was found that less ambiguity resulted in greater job satisfaction and less job-related tension.

The report considers the limitations of cause-effect relationships between two variables and cautions against "organizational scientism." Building upon the results from computer analysis, the study's second stage explored the possibility of organizational payoffs associated with job ambiguity.

A total of 40 interviews was conducted across the Center. Ten AST's were selected from each of the four Directorates. They were chosen on the basis of their job ambiguity scores. Consequently, the two lowest, the two highest, and six whose scores approximated the middle value were interviewed.

The results indicated that a certain degree of job ambiguity was functional and interrelated with the nature of the ASTs' work group environment. However, the interviewees with high ambiguity scores generally reported detrimental effects associated with a high degree of uncertainty concerning their organizational position.

The report goes on to consider the interface between a consultative management style and the professional's need for participation and involvement in organizational matters. The interviews lend support to these considerations. The implications concerning the relationship between

organizational effectiveness, job ambiguity, and a consultative management approach are reviewed in terms of the Center's capability to cope with and adapt to political, economic, and technological uncertainties in its environment.

As substantiated by the follow-up interviews, the study contends that the nonsupervisory ASTs' favorable attitudes toward their organization and position are the basis for the following recommendations:

1. It is recommended that the professional's commitment to the organization be enhanced by expanding his participation in three management dimensions. These are: Decision-making; organizational goals; and control.

2. It is recommended that reality-oriented management by participation be implemented. It is participative in that each AST has the opportunity to share in nontechnical organizational matters and reality-oriented in that management is still responsible for the organization's mission.

3. Management development is considered the implementation vehicle for recommendation 2.

4. Concerning job ambiguity, it is recommended that goals be clearly defined, but the means of accomplishment should be left up to the individual. Since a certain degree of ambiguity or uncertainty was found to be organizationally functional, this recommendation provides job structure for high ambiguity cases, and more freedom of action or flexibility for low ambiguity scorers.

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CHAPTER I

THE PURPOSE

This management publication has evolved from the author's doctoral dissertation, a field study which was conducted at the Manned Spacecraft Center (MSC) in Houston, Texas.¹ The primary purpose of this report is to provide management a comparative analysis of the attitudes or perceptions that nonsupervisory professionals (Aerospace Technologists) have toward their organization and position. Data was collected from those Aerospace Technologists (AST's) in the following Directorates: Engineering and Development; Flight Operations; Science and Applications; and Flight Crew Operations.

The findings culminated in a "Center-wide" analysis of the following variables: Management styles; job ambiguity which measured how clear the AST was about duties, and his supervisor's expectations and evaluations; job satisfaction; job tension; and the interface between the variables enumerated and the professional's work environment. From the analysis, recommendations that reflect MSC's state of "organizational health" are presented.

The remainder of this chapter concerns the development of an appropriate, conceptual framework commensurate with the empirical aspects of this study. The author considers the variables or measures to be analyzed as indicators of organizational effectiveness. The effective organization is one which can absorb and react to the political, economic, and technological stresses in its environment. Its managerial philosophy is one that is characterized by adaptiveness and experimentalism. It is a "young" organization in the sense that its personnel are willingly engaged in risk-taking behavior. New and unique approaches, or ways of solving problems, are readily explored. In general, a healthy attitude toward change permeates the organization.

To investigate what the author has called the organizational environment or its state of health, a questionnaire and a set of open-ended interview questions were developed to measure the variables explored in this study. The data collection instruments are presented in Appendices A and B.

Referring to Appendix A, Part I investigated the professional's organizational orientation. These questions concerned management styles

¹Richard A. Hamilton, "An Analysis of Position Ambiguity and Its Consequences in a Research and Development Organization." Prepared under the auspices of the Graduate Resident Research Fellowship Program. NASA-Manned Spacecraft Center, Houston, Texas (Unpublished Ph.D. dissertation, The University of Southern California, Los Angeles, January, 1969).

which were evaluated in terms of six characteristics or dimensions. The four management styles to be evaluated were:

- Style #1. Exploitive Authoritative (for example, relatively no concern for the human element in the organization; people viewed much the same as materials and tools; relatively all decisions are made at the top).
- Style #2. Benevolent Authoritative (for example, some but little concern for the human element in the organization; concern mostly in a paternal or a manipulative manner; most decisions are made at the top).
- Style #3. Consultative (for example, relatively sensitive and concerned for the human element in the organization; people are not viewed as materials and tools but with motives, desires, and productive potentialities; members are generally consulted, however, many decisions are made at the top unless they can be made more appropriately at lower organizational levels.)
- Style #4. Participative (for example, relatively high cognizance of the human element in the organization; highly sensitive to the human variable; generally the group makes the decision).

If these four styles of management were placed on a continuum, one might expect Style #1 to be highly authoritative and incompatible with the professional's attitude toward involvement and participation in the decision-making process. On the other hand, Style #4 is viewed as a favorable management approach in a professionally oriented organization such as the Manned Spacecraft Center.

The six characteristics contributing to each of these management styles were: Leadership; motivation; communication; decision-making; organizational goals; and control.

Part II of the questionnaire considered the professional's position orientation. This portion of the questionnaire provided information concerning three areas related to the individual's job. They were: How clear he was about his performance; the resulting tension or anxiety associated with a lack of job clarity or understanding; and job satisfaction at MSC.

The author developed two general hypotheses concerning this portion of the questionnaire:

1. There is a direct relationship or association between job clarity or ambiguity and tension.

2. There is an inverse relationship or association between job clarity or ambiguity and job satisfaction.

The third part of the questionnaire provided demographic information concerning the nature and composition of the participants in this study. Building upon the questionnaire results, the second phase of the writer's research was a series of 40 follow-up interviews. The method of interviewee selection will be reviewed in Chapter II, "The Research Design."

Whereas Part II of the questionnaire focused on the individual consequences associated with job ambiguity, the interview phase explored the possibility that ambiguity may be functional rather than detrimental to the individual and the organization. Essentially, the writer's aim was to dispel a managerial myth concerning ambiguity's dysfunctional attributes to the organization.

The literature on the subject of ambiguity's functional or beneficial payoff to the organization is rather scanty. Thus, the interview findings are somewhat exploratory.

The writer surmised that a certain degree of ambiguity or doubt surrounding the individual's duties and responsibilities to the organization encourages initiative. Concerning one's job, it is sometimes better "to leave certain things unsaid." The individual needs "breathing room" in the performance of his task. Job ambiguity becomes functional when it promotes maneuverability and flexibility. In an applied research and development organization such as the Manned Spacecraft Center, task or job flexibility is quite important.

As Professor Fred Massarik has indicated in his paper entitled Functional Ambiguity and the Cushioning of Organizational Stress, a relationship exists between ambiguity and organizational effectiveness. There is an optimal point where a certain degree of ambiguity is functional and necessary for organizational effectiveness. If functional ambiguity can prepare the professional to work in an environment characterized by stress, then it is surmised that the organization's capacity to adapt to change will be enhanced.

If the Manned Spacecraft Center is going to be a viable organization, it should be able to tolerate the stresses created by political, economic, and technical uncertainties. After the Apollo Program, new missions will be established. Change and its corresponding stresses will confront MSC management. The healthy organization can readily adapt to a change in management philosophy. Accordingly, the interviews focused on ambiguity or uncertainty and its implications to MSC.

When ambiguity is functional, it prepares the individual to cope with the uncertainties of the future. Its presence creates a certain degree of permissiveness or flexibility. On the other hand, a high degree of clarity associated with the task creates a structured situation which is not conducive to change and stress. Conversely, too much ambiguity

leads to excessive tension and dissatisfaction which is detrimental to the organization's coping capability.

From these tentative notions, a series of hypotheses was derived:

1. Tension, dissatisfaction and a lack of job clarity are reactions associated with a high ambiguity score.
2. Ambiguity is functional for the AST whose score approximates the median value.
3. Tension, dissatisfaction, and a lack of job clarity are reactions not associated with a low ambiguity score.

The interview questions were constructed on the basis of these hypotheses. (Please see Appendix B.)

CHAPTER II

THE RESEARCH DESIGN

The participants in this study were nonsupervisory Aerospace Technologists (hereafter referred to as AST's) whose GS grades were: 7; 9; 11; and 12. The AST's perform various functions relegated to those individuals in the 700 occupational code group series. This group includes professional AST positions engaged in Aerospace research, development, operations, and related work, (including the development and operation of specialized facilities and supporting equipment), for which a college degree is a basic qualification requirement.

A computer printout provided the names of those individuals who were nonsupervisory AST's. From this master list, the population, or total number of 958 professionals, was established.¹

Since the study's objective is to provide management a comparative analysis, the population was stratified on the basis of organizational identification. Thus, the 958 AST's were stratified in the following manner: Engineering and Development - 364; Flight Operations - 401; Science and Applications - 70; and Flight Crew Operations - 123. Mailed out questionnaires and follow-up interviews were the primary data collection instruments. Whenever a mailed-out questionnaire is used, the risk exists that an adequate number of questionnaires will not be returned. Thus, if the sample selected from its population is not large enough, inferences or predictions cannot be made. Consequently, the sample size for each Directorate was inflated. This insured the return of a sufficient number of questionnaires. Each AST in the population was assigned a number. By referring to a table of random numbers, a random sample of AST's was selected from each Directorate. In essence, this random selection procedure insured that each AST in the population had an equal chance to be included in the study's sample.

Table 1 on page 6 presents, in a descriptive manner, the population and sample size for each Directorate, percent of population sampled, number of questionnaires returned, percent of population returned, and percent of sample returned. In contrast with the other Directorates, a

¹Initially, there was a population of 985 which included AST's in areas other than Engineering and Development, Flight Operations, Science and Applications, and Flight Crew Operations. Later, it was decided to exclude AST's working in areas other than those enumerated because of their relatively small number when compared with the rest of the AST population.

TABLE 1

A DESCRIPTIVE ANALYSIS OF THE STUDY'S SAMPLE

Directorate	Population	Sample Size	Percent of Population Sampled	Number of Questionnaires Returned	Percent of Population Returned	Percent of Sample Returned
Engineering and Development	364	87	24	44	12	50
Flight Operations	401	66	16	54	13	82
Science and Applications	70	66	94	36	51	54
Flight Crew	123	63	51	32	26	50
TOTAL	958	282	29	166	17	59

large percentage of the questionnaires from the Flight Operations Directorate was returned.² It was anticipated that a smaller percentage of questionnaires would be returned from the other Directorates. The percentage returned, however, was sufficient to allow inferential statements to be made. Tables 2 and 3 on pages 8 and 9 are directorate profiles which identify at division level the organizational location of the returned questionnaires. Thus, in Engineering and Development, most of the returned questionnaires came from Computation and Analysis; in Flight Operations, from Mission Planning and Analysis; in Science and Applications, from Space Physics; and in Flight Crew Operations, from Flight Crew Support.

Numeric values, or weights, were assigned to the questionnaire's response alternatives. This coding procedure permitted the researcher to statistically analyze the data collected from the mailed-out questionnaires. A FORTRAN computer program was subsequently written. Its results will be presented in the next chapter.

To test the second group of hypotheses concerning the functionality of ambiguity, 40 interviews were conducted. Individuals to be interviewed were selected on the basis of their response to the first five questions in Appendix A, Part II (Position Orientation). Recalling that these questions concern how clear the individual is about his job, the participants' choices to the available alternatives were coded with numeric weights. Then the participants' total scores in each Directorate were arrayed from low to high. Ten respondents from each Directorate were selected from this array. The author interviewed the two lowest, the two highest, three whose scores were just below the median and three whose scores were just above the median.

Prior to asking any of the interview questions (Appendix A, Part IV), each interviewee was told where he ranked in terms of job ambiguity. The interviewer reviewed with the respondent the alternatives he selected. This review provided a frame of reference for the interview questions to follow. The interview questions were selected for the following reasons: Question 1 - to insure that the interviewee's responses were in context with his completed questionnaire; Question 2 - to explore the relationship between job ambiguity and performance; Questions 3 and 4 - to prove the interviewee's need for structure and guidance; Questions 5 and 6 - to acquire information concerning the degree of interaction and supportive relationships present in the individual's work environment; Question 7 - to obtain a general statement that describes the procedure used to cope with job ambiguity.

²The management in Flight Operations gave the researcher permission to administer the questionnaire by assembling the participants into small groups. Those who were not able to attend one of the group meetings, or did not finish completing the questionnaire, were asked to complete and return it by inter-office mail.

TABLE 2

DIRECTORATE PROFILE OF ENGINEERING AND DEVELOPMENT QUESTIONNAIRES RETURNED FOR EACH DIVISION

<u>Organizational Location</u>	<u>Frequency</u>
Directorate Office	1
Information Systems	1
Crew Systems	8
Computation and Analysis	10
Instrumentation and Electronic Systems	7
Guidance and Control	3
Propulsion and Power	6
Structures and Mechanics	3
Advanced Spacecraft Technology	5
TOTAL	44

DIRECTORATE PROFILE OF FLIGHT CREW OPERATIONS QUESTIONNAIRES RETURNED FOR EACH DIVISION

<u>Organizational Location</u>	<u>Frequency</u>
Aircraft Operations	1
Flight Crew Support	31
TOTAL	32

TABLE 3

DIRECTORATE PROFILE OF FLIGHT OPERATIONS QUESTIONNAIRES RETURNED FOR EACH DIVISION

<u>Organizational Location</u>	<u>Frequency</u>
Flight Control	11
Landing and Recovery	11
Mission Planning and Analysis	21
Flight Support	11
TOTAL	54

6

DIRECTORATE PROFILE OF SCIENCE AND APPLICATIONS QUESTIONNAIRES FOR EACH DIVISION

<u>Organizational Location</u>	<u>Frequency</u>
Lunar Surface Project Office	3
Applications Project Office	4
Test and Operations	4
Space Physics	17
Lunar and Earth Sciences	8
TOTAL	36

The interviews were analyzed in terms of the hypotheses which considered the functional aspects of job ambiguity for a mission oriented research and development organization. The findings from these interviews are presented in Chapter III, "The Results."

CHAPTER III

THE RESULTS

From the questionnaire's background and experience data, the following picture of sample homogeneity has been developed: Most of the participants are under 30 years of age; are GS-11's and 12's; have been in their present position with the same supervisor for one year; perform a development function; have a bachelor's degree in engineering. Although exceptions will exist, it is surmised, however, that the homogeneous nature of this sample precludes attributing to the background and experience variables any unusual variations in the results.

Table 2 on page 12 descriptively portrays the most frequently occurring responses for each characteristic presented in this study. In-depth profiles of each characteristic are presented in Appendix C. The frequency columns in Appendix C refer to the number of responses for each category. Their respective percentages are presented in the adjacent column. The characteristics that focus on length of service at the Manned Spacecraft Center, length of service in present position and with the same supervisor have been rounded to the nearest year. For example, if an AST has worked in his present position for one year and six months, the length of service in his present position appears as two years.

The graphs presented in Figures 1 to 4 on pages 13 through 16 are a result of computer analysis. Their meaning is explored in terms of the report's primary purpose (to provide management a comparative analysis of the attitudes and perceptions that nonsupervisory AST's have toward their organization and position). Also the hypotheses stated in Chapter II are analyzed on the basis of these findings. Where appropriate, the author has interfaced the interview data with the report's primary purpose.

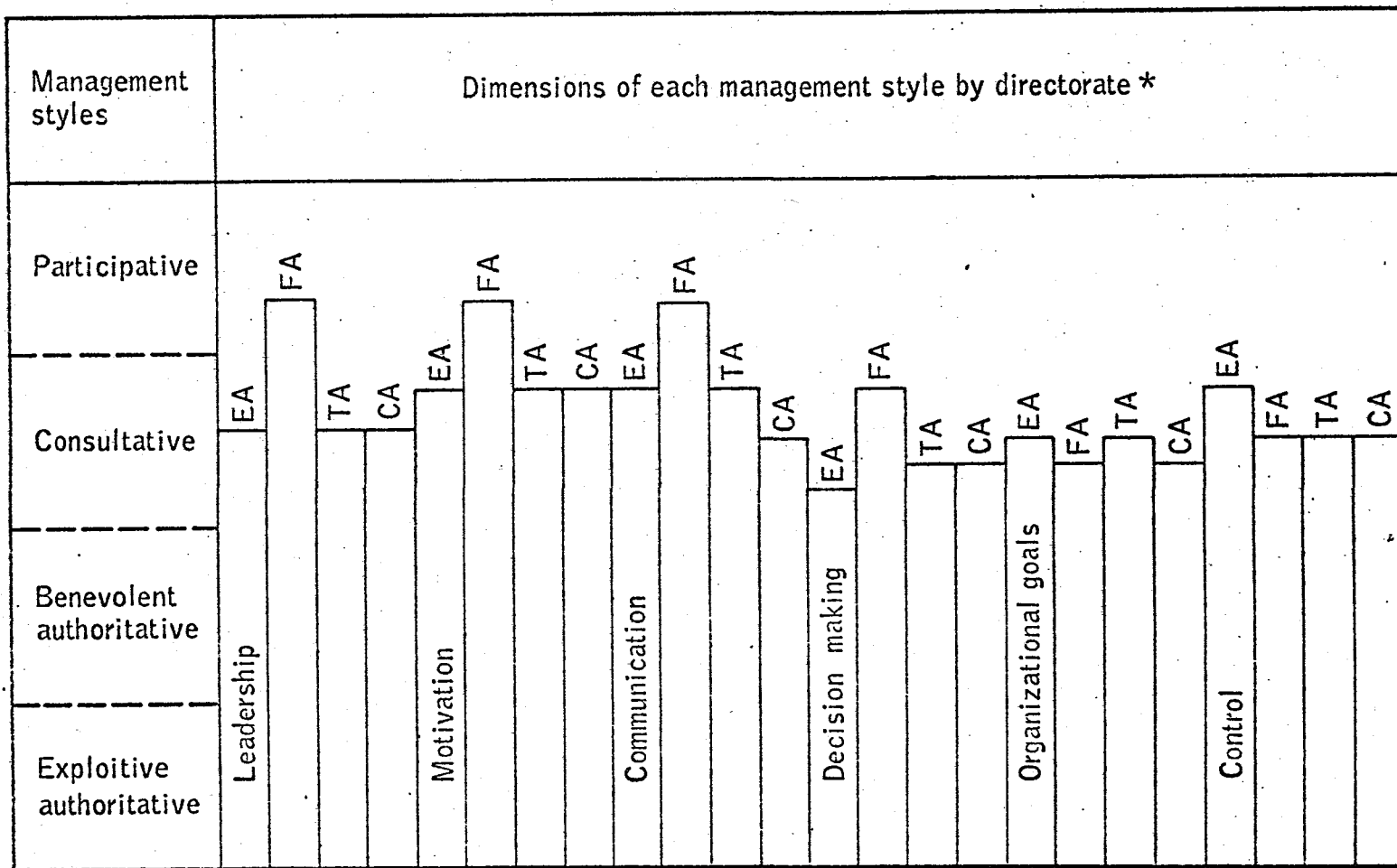
Accordingly, Figure 1 is a profile of management styles at MSC. Examination of this graph indicates that a consultative style of management is the predominant supervisory approach across the Center. Since MSC is primarily an applied research and development type organization, a consultative and, in some instances, a participative style prevails. Recalling the management style continuum in Chapter II, this graph is an indication that the ASTs' perceptions of their supervisor's approach to management are favorable.

There are, however, three dimensions or characteristics which warrant review. These are: Decision-making; organizational goals; and control. These three dimensions were measured by questions 11 to 20. (Please see Appendix A, Part I.) In general, these questions are reflective of the degree of participation, involvement, and individual freedom or independence throughout the organization. In a complex organization such as MSC, these are important attributes because of the large number of scientific-engineering professionals employed at the Center.

TABLE 2

BACKGROUND AND EXPERIENCE PROFILE OF MOST FREQUENTLY OCCURRING RESPONSES
FOR EACH DIRECTORATE

Characteristic	Engineering and Development	Flight Operations	Science and Applications	Flight Crew
Age	26 - 30	26 - 30	26 - 30	26 - 30
Present Salary Grade	12	12	12	11
Length of Service	3 years and 5 years	2 years	1 year	1 year
Length of Service - Present position	1 year	1 year	1 year	1 year
Length of Service - Present supervisor	1 year	1 year	1 year	1 year
Function Performed	Development	Development	Research Contract Moni- torship Other	Development
Educational Level	Bachelor degree	Bachelor degree	Bachelor plus some graduate work	Bachelor degree
Major in College	Engineering	Engineering	Physics	Engineering
Major in Graduate School	Engineering	Mathematics	Physics	Physics and Engineering



* Directorate code: EA - Engineering and Development TA - Science and Applications
FA - Flight Operations CA - Flight Crew Operations

Figure 1. - Management styles profile by directorate.

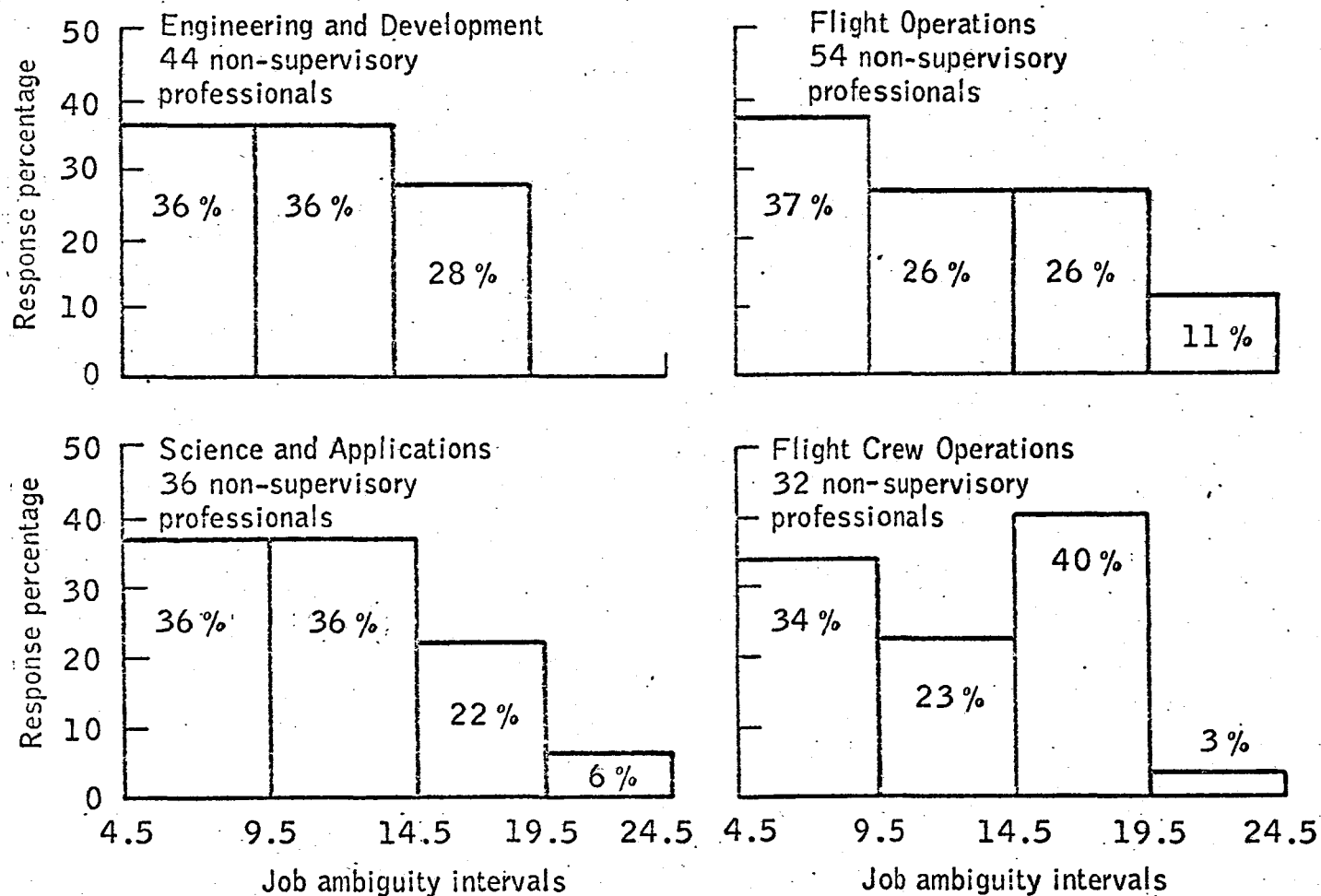


Figure 2. - Job ambiguity profile by directorate.

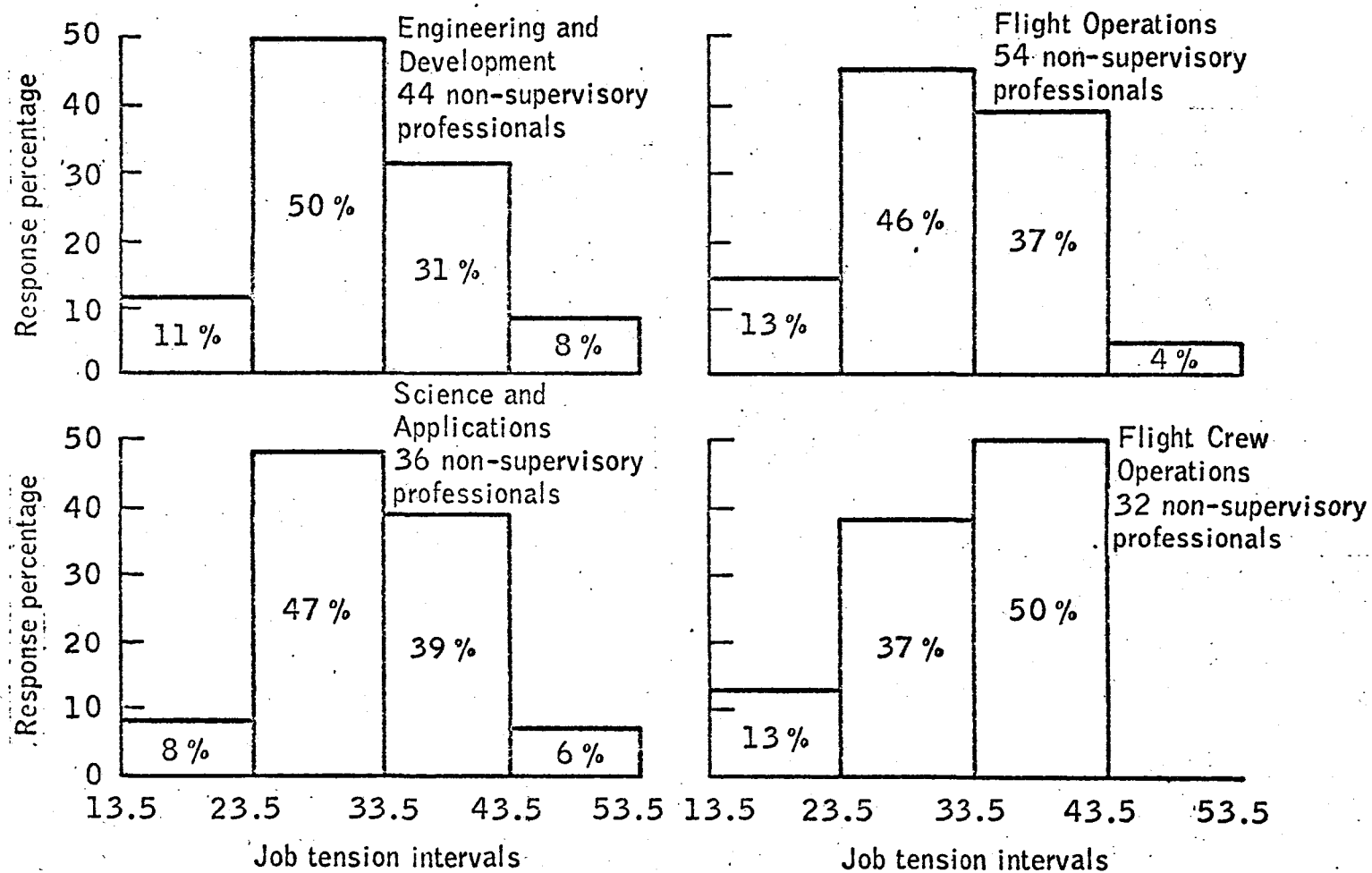


Figure 3. - Job tension profile by directorate.

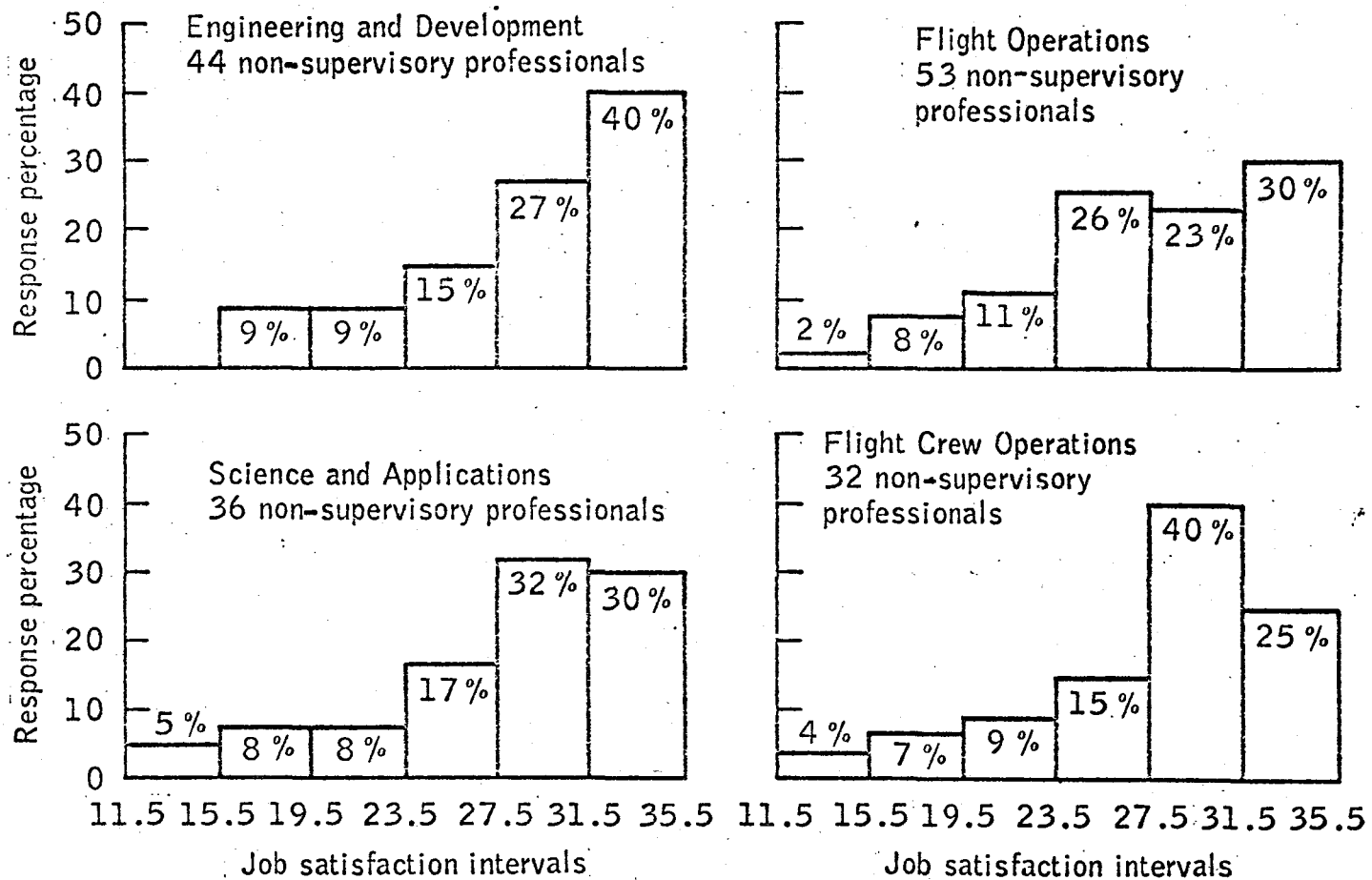


Figure 4. - Job satisfaction profile by directorate.

Although the supervisor's approach in these areas was reported as consultative, it is recommended that the AST be given a "greater voice" in matters pertaining to his position. The interview findings tend to support this recommendation. Accordingly, it was reported by the interviewees that they preferred a minimal amount of direction and control, and a need for independence and freedom in making decisions.

Management should encourage greater participation because it will broaden the base of organizational consensus. However, participation does not imply "organizational anarchy." Rather, a reality-oriented management by participation is recommended. From the author's experience in various organizations, he is not suggesting that MSC replace its formal, legitimate organizational structure. Within this framework, however, the author is suggesting that it is quite possible to broaden the organization's interpersonal relationships by expanding the degree of individual participation. This is "organizational democracy" which is another way of saying reality-oriented participation. The approach is democratic in that each individual has the opportunity to share and participate in organizational matters. It is reality-oriented in that management is still responsible for the organization's goals.

This approach has led the author to consider an important question: As an organization, can MSC cope with the change and stress that this approach might entail? In answer to this question, the interview findings and the results presented in Figure 1 are quite encouraging. In general, a collaborative, group consensus to solving problems of a technical nature characterizes the work environments across the Center. Most of those interviewed felt that the group problem-solving approach was quite important. The sharing of information with their professional colleagues generated new and better ways of handling technical problems. Thus, by expanding incrementally the present parameters, the scope of group consensus would include nontechnical, organizational matters. This should increase the professional's involvement, commitment, and understanding of organizational problems.

The recommended implementation vehicle, and also another spin-off from reality-oriented management by participation, is organizational development. Through increased participation, the professional engineer-scientist develops a greater awareness and perspective beyond his immediate work group. Essentially, the technical manager becomes involved in the development of the organization's managers for tomorrow.

Whereas Part I of the questionnaire has focused on the individual's orientation to his organization, the findings in Part II, Position Orientation, shift the level of analysis to the professional's reactions to his position in the organization. Figures 2 to 4 portray in graphic form three variables concerning the ASTs' attitudes toward their jobs across the Center.

Figure 2 is a comparative analysis of the degree of ambiguity or the lack of job orderliness or clearness among AST's across the Center. The lowest and highest possible scores obtainable were 5 and 25, respectively. Thus, a score of 5 means that the individual's job is "crystal clear," while one of 25 indicates an extreme atmosphere of uncertainty, confusion, and chaos. Examination of Figure 2 indicates that a relatively small number of AST's fell into this latter category. Typically, an AST in this category reported that he was unclear about his supervisor's expectations, i.e., not knowing what he expected from him, his evaluations, i.e., uncertain concerning how satisfied he was with his performance, and, in general, the lack of understanding concerning his duties.

Among those interviewed in this group, the interview findings revealed ambiguity's dysfunctional aspects to the individual and, subsequently, the organization. Interviewees reported: The group's general level of performance was hindered; the amount of direction and control received was inadequate; some felt it would be better if more of their duties were in writing, while others indicated the need for better communication with their supervisor.

Concerning the methods used for solving problems and handling uncertainties, interview responses ranged from poor or no group interaction and support to some consultation with colleagues and the supervisor. In general, it was felt that verbal information was not adequate. The interviewees' resultant need for formal, written guidelines was apparent. On the other hand, more than 33 percent of all the samples returned reported that their job was quite clear.

Referring to the interview findings for this group, a favorable summary of the results emerged. Most of the individuals did not want more in writing. In general, the direction and control received was functional. Group interaction and involvement was the predominant approach to problem-solving and treating ambiguous situations that arose. In addition, the low ambiguity group indicated that their performance level had not been adversely affected.

Turning now to those interviewees whose ambiguity responses approximated the median score for each Directorate, the findings generally supported the report's contention concerning the functional aspects associated with ambiguity. The individual's performance had not been restricted, and a climate of group interaction and involvement seems to have developed. Most of those interviewed indicated that they did not want more of their duties and responsibilities in writing. The amount of direction and control received was reported as adequate. Whereas informal understandings were generally dysfunctional for those with a high ambiguity score, these informal arrangements appear to be beneficial for this group whose scores approached the middle value for each Directorate.

The interview summaries and the questionnaire responses have brought us to a consideration of their implications and subsequent recommendations. Apparently, the degree of ambiguity or uncertainty associated with one's task interfaces with other environmental characteristics. Job tension, job satisfaction, and the nature of the AST's work group relationships seem to be interrelated with each other. Statistical analysis revealed positive, direct measures of association or relationship between job ambiguity and job tension, and, accordingly, negative, inverse measures of association between job ambiguity and job satisfaction. Essentially, the author found that the less the ambiguity or uncertainty surrounding the individual's position in the organization, his resulting reactions were: Less tension and greater job satisfaction.¹

Figures 3 and 4 on pages 15 and 16 are a graphic presentation of job tension and satisfaction for each Directorate. The range for the lowest and highest possible tension scores was 14 to 70, respectively. Thus, a score of 42 would represent a median or middle range tension value. Visual examination reveals that job-related tension across the Center is not excessive. Considering the relatively small number of high ambiguity responses, it is to be expected that tension is not high among the AST's.

Analyzing Figure 4, Job Satisfaction Profile for Each Directorate, the author notes the emergence of a similar pattern. Hypothetically, the lowest and highest possible job satisfaction scores one might obtain were 7 or 35, respectively. A score of 21 would represent a median or middle range value. The actual range, however, was from 12 to 35. Its corresponding middle range value was 23.5, a score that is above the hypothetical middle range response of 21.

Visual inspection of this graph indicates that more than 75 percent, and in one case 82 percent (Engineering and Development), of all the job satisfaction scores were above a median of 23.5. Again, considering the ambiguity scores, but this time the relatively high number of low scores (33 percent), it is not surprising that job satisfaction across the Center is quite favorable.

An implication that one might be tempted to draw from these results is: Whenever it is possible, seek to avoid the uncertainty surrounding the professional's position in the organization. Thus, ambiguity becomes a hindrance or an obstacle standing in the way of organizational effectiveness. From the follow-up interviews, however, several deviations from the statistical analyses were reported. Factors such as the job's intrinsic

¹The correlation coefficients for each Directorate are presented in Appendix C. The method of statistical analysis was Spearman's rank order correlation coefficient. This is a well-known nonparametric statistic. Sidney Siegel's book, Nonparametric Statistics for the Behavioral Sciences, is recommended for those interested in additional information.

value or reward and the personality needs of the individual involved can act to influence his tolerance for uncertainty and its associated anxiety or tension.

Thus, one of the interview implications is that we must be cognizant of the limitations or qualifications associated with statistically significant correlations. Whereas the laboratory scientist can readily control and sometimes manipulate his environment, the organizational analyst cannot. In his quest for a place in the scientific community, significant correlations might tempt him to see a cause-effect relationship among the variables under his organizational microscope. However, our experience reminds us of the many intervening variables that act to distort our generalizations. Some of these variables are: The job itself; personality needs; management style; and work group relationships.

Consideration of management styles in Part I of the questionnaire revealed an overall management mix that was consultative-participative in nature. Supporting these findings are collaborative, group problem-solving relationships reported by those interviewees with a median or low job ambiguity score. Conversely, those with high ambiguity scores described an environment in which these individuals were not able to cope with or handle its subsequent uncertainties and stress.

To summarize, there seems to be a symbiotic interdependence between the intervening variables and the uncertainty in the AST's position. The implication is that job ambiguity needs to be analyzed systematically. The findings indicated that job ambiguity may promote viable, interpersonal relationships, provided, of course, that the professional is aware of his goals or objectives. On several occasions this was reported to the interviewer. However, the means of accomplishing these objectives or goals should be left up to him. Generally, this approach is compatible with the professional's need for autonomy and independence.

From these implications, the following recommendations are made:

1. Regardless of an individual's ambiguity score, it is imperative that the immediate supervisor communicate to his nonsupervisory AST's their objectives or goals. In some circumstances, this will entail the supervisor obtaining clarification from his management.

2. In terms of "long-run" organizational health or effectiveness, it is recommended that the AST be given as much freedom as possible in the performance of his job. Specifically, the professional's job should not be "crystal clear." A little ambiguity prepares the individual to assume positions which require increased risk-taking behavior. Essentially, it "readies" the individual for the future. One is reminded of those AST's whose ambiguity scores approximated the median for each Directorate. Recalling their viable group relationships and the desire

not to have more of their duties and responsibilities in writing, ambiguity did not hinder the job performance for this group of AST's.

Accordingly, ambiguity becomes an ally rather than management's traditional foe. As a method of managerial development, it promotes flexible, as opposed to rigid, structured thinking. Broadly defined guidelines permit the professional to evaluate the trade-offs associated with the various alternative means of accomplishing organizational ends. With each decision, this approach should dramatize its resulting rewards or penalties.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

The research in this study consisted of three phases. The first phase involved a compilation of the questionnaire's background and experience data. The second phase was an empirical investigation of management styles across the Center, and it measured the degree of association between job ambiguity, tension, and job satisfaction.

A consultative management style which tends toward a participative approach emerged from the data analysis. However, it is recommended that additional effort be expended among three of the dimensions or management measures. These are: Decision-making; organizational goals; and control. These dimensions are important ones because of their relationship with the professional's need for involvement. Consequently, it is also recommended that a management style which the author has called "reality-oriented management by participation" be implemented. To paraphrase an earlier statement, it is participative in that each AST has an opportunity to share in nontechnical organizational matters. Conversely, it is reality-oriented in that management is still responsible for the organization's mission. Because management development provides the individual an increased awareness of his role in the organizational scheme of things, the author recommends its use as a means of implementing reality-oriented management by participation.

Computer analysis of the questionnaire showed that positive measures of association between ambiguity and job tension, and negative measures of association between ambiguity and job satisfaction were established. Thus, the two general hypotheses stated in Chapter II are accepted:

1. There is a direct relationship or association between job clarity or ambiguity and job tension.
2. There is an inverse relationship or association between job clarity or ambiguity and job satisfaction.

The study's measures of association between these variables are statistically significant. Consequently, inferences were made from the sample results of 166 AST's to its population of 958 GS-7's, 9's, 11's, and 12's. (See Appendix C.)

On the whole, analysis of the graphs in Chapter III indicated that job ambiguity and job tension were relatively low, and job satisfaction was high. Linking the findings from this portion of the questionnaire with Part I's Organizational Orientation, a comparative, across-the-Center analysis reveals that the attitudes or perceptions that AST's have toward their organization and position are healthy.

Phase three of the research was primarily descriptive and somewhat exploratory. Building upon the results found in phase two, this second thrust considered whether or not there are any organizational payoffs associated with job ambiguity. The results in Chapter III indicated that a certain degree of job ambiguity was functional and interrelated with the nature of the AST's work group relationships. Thus, the second group of hypotheses stated in Chapter II was accepted.

1. Tension, dissatisfaction, and a lack of job clarity are reactions associated with a high ambiguity score.

2. Ambiguity is functional for the respondent whose score approximated the median value.

3. Tension, dissatisfaction, and a lack of clarity are reactions not associated with a low ambiguity score.

Acceptance of hypothesis 2 has resulted in the following recommendations: Concerning hypothesis 1, it is recommended that the tension and dissatisfaction be reduced by clarifying the goals or objectives related to a specific job; referring to hypothesis 3, it is recommended that the AST be given more freedom of action. Although tension was not reported by interviewees with a low ambiguity score, some in this group were dissatisfied with the lack of challenge and routineness created by too much job structure.

Since the median group did not find a certain degree of job ambiguity detrimental, it is suggested that the low ambiguity AST's be given more job flexibility. However, in all cases, it is essential that their organizational goals be clearly defined. A lack of well-defined goals was a major contributory factor to job ambiguity. For example, among those AST's interviewed with a high ambiguity score, a lack of goal direction was readily apparent.

It is inferred that the conclusions lend support to the author's basic contention concerning ambiguity and its implied relationship with organizational effectiveness. The following excerpt from a paper prepared by Professor Fred Massarik crystallizes the report's position concerning ambiguity and its organizational implications:

Too little ambiguity makes it impossible for individuals and organizational subsystems to "roll with the punch" of changing and often to themselves ambiguous, organizational performance requirements; . . . such dearth of ambiguity promotes conflict because it leaves no room for potentially opposing individuals or organizational subsystems to back off, or to meet halfway, within a no-man's land of "functional ambiguity." Too much ambiguity surely impedes organizational effectiveness by creating overwhelming anxiety for the individuals and by

obscuring guidelines necessary for organizational survival. However, between these two extremes falls a range of ambiguity levels that is indeed adaptive as viewed from the standpoint of organization and/or individual.¹

Although a certain degree of uncertainty pervades any organizational system requiring cooperative human effort, the interview findings revealed uncertainty's functional aspects to the organization and the individual. Recalling that management development was the recommended implementation vehicle for a reality-oriented participative approach; in conclusion, it is recommended that management consider functional ambiguity an important implementation component of this system.

Having presented the report's conclusions and recommendations, its Epilogue shall concentrate on the findings' long-term implications for the Manned Spacecraft Center. These implications reflect the author's observations during his stay at the Center.

¹Fred Massarik, Functional Ambiguity and the Cushioning of Organizational Stress, A research paper supported by the National Aeronautics and Space Administration. Prepared by the Division of Research, Graduate School of Business Administration (Los Angeles: University of California, 1966), p. 3.

THE EPILOGUE

The effective organization copes and adapts with organizational stress and change. To paraphrase an earlier statement, if the Manned Spacecraft Center is going to be an effective organization, then it should be able to cushion itself against the stresses created by political, economic, and technical uncertainties in its environment.

As a theme in administration, functional ambiguity can condition and, in a sense, prepare the individual to "live with uncertainty and stress." It encourages him to seek new and unique approaches to solving problems. Within his work group, uncertainty requires the project member to share his limited information with others engaged in a mutual problem. This atmosphere of participation and involvement is compatible with the professional's need to be committed.

Thus, if functional ambiguity has been a contributing factor in the development of a participative climate, then the following question needs to be posed: What are its future implications as far as the Manned Spacecraft Center is concerned?

To answer this question, it is necessary to review some of the environmental factors that interface with the Manned Spacecraft Center. The Cape Kennedy fire in January 1967, resulted in an extensive review of all Apollo systems. At the Manned Spacecraft Center, some of the professional personnel involved in "downstream" Apollo Application projects were assigned to the Apollo Program as contract monitors. Thus, a viable organizational commitment to Apollo permeates the Center.

Other constraints such as our domestic problems and the Vietnam War have resulted in budgetary cutbacks. Particularly, the Apollo Applications phase of the space program has been affected by these cost factors. The recent Apollo 7 successful launch has brought the Apollo Program closer to its objective (a successful moon launch, landing, and recovery of the command module). However, the completion of Apollo means the implementation of new goals for the Manned Spacecraft Center management. Some of the possible options are: Manned lunar exploration; manned planetary exploration; furnishing Apollo Application crews; and combinations of these alternatives.

A healthy organization can adapt to a change in managerial philosophy. A certain degree of ambiguity has been beneficial for the Center's organization. The Aerospace Technologists have found it necessary to participate and share information with their colleagues. This has resulted in the formation of participative work groups throughout the Center. Thus, when the Apollo Program is terminated and the Center is subjected to the stress created by changing goals, these participative groups will act as an organizational "shock absorber." This is what the author considers as ambiguity's contribution to the organization's state of readiness.

Barring unforeseen complications, we will see a successful moon launch in 1969. Assuming the American Space Program will continue after Apollo, the author's implications concerning the functionality of ambiguity should become apparent in 1970.

APPENDIX A

GENERAL INFORMATION

This questionnaire is part of a study being conducted by Richard Hamilton, a graduate student at the University of Southern California in Los Angeles. While conducting my study, I am temporarily assigned to the Management Research Center, a section of the Management Analysis Branch. My mail code is BM22 and my telephone number is 5427. When this study is completed, I will return to the University of Southern California.

Top management is interested in this study because it is a comparative analysis of the work environments of non-supervisory professionals. An important objective is to learn more about the effect that managerial behavior has upon the attitudes and perceptions of professional personnel at the Manned Spacecraft Center.

There are a number of questions within this questionnaire which touch on areas that you will undoubtedly feel are personal. Your openness and frankness is essential. Do not feel that you are being "tested" against arbitrary standards of right and wrong. All of these questions are a matter of degree and there is no "right" or "wrong" answer. Although there are probably some items which will appear irrelevant to you, each item was selected for a specific purpose. It is important that you answer all of the questions.

Like most questionnaires, the information within this one could be used to identify the person who filled it out. Rather than begin with the statement that the questionnaire is to be anonymously filled out when we both know better, I would prefer that we are more open with each other. As a consequence, your name has been coded and placed in the upper right-hand corner of the questionnaire. This will serve two purposes. The first is that if there are any problems with the completed form I can then come to you for clarification. Second, having your name on the form will prevent the possibility of accidentally placing a person in the wrong directorate, division, branch, or section when the data is compiled. Placement in the wrong organizational unit would distort an accurate picture of the work environments at the Center. Thus, the report's value as a comparative analysis would be seriously affected. I hope you understand why I placed your name on the questionnaire.

I would like to add that no one other than myself and a keypunch operator will be allowed to see the completed questionnaires. In fact, when the data from it is punched on IBM cards, your name will not be included.

When the report is completed I intend to provide a copy of the results to everyone who participated in the study. Please return your completed questionnaire by April 4th in the self-addressed envelope.

Thank you,

Richard Hamilton
University of Southern California

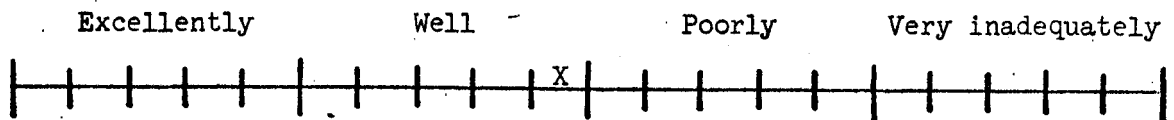
PART I

ORGANIZATIONAL ORIENTATION¹

On the following pages is a series of questions about aspects of your organization. You are asked to select the answer which--in your opinion--is most appropriate for your situation. Place an "X" in the small guide marks to shade the emphasis of your answer.

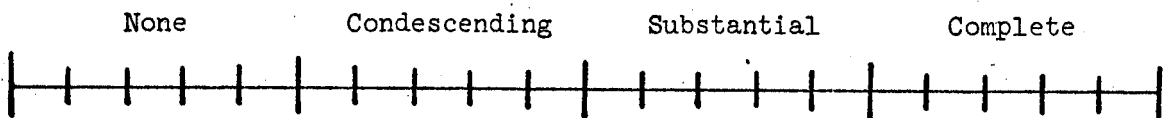
EXAMPLE:

How well-informed is the division's top management?

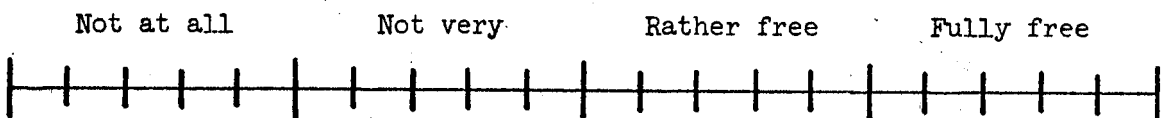


This answer means that top management is generally well-informed, but that some weaknesses exist which tend to detract seriously from the knowledge of the group's leaders.

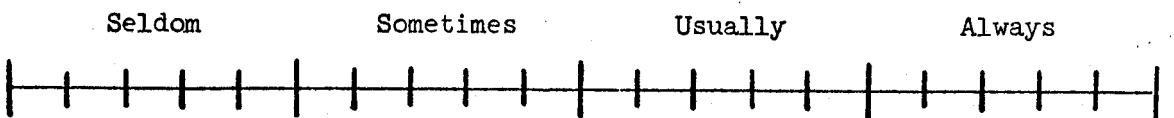
1. How much confidence has management shown in subordinates?



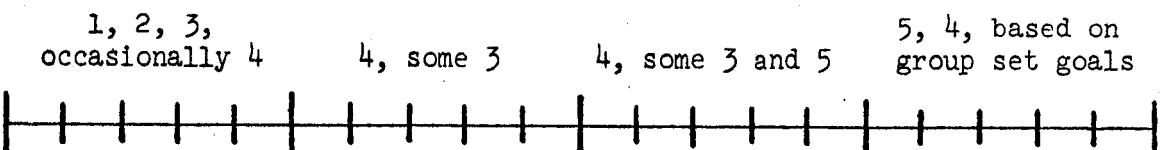
2. How free do subordinates feel to talk to superiors about job?



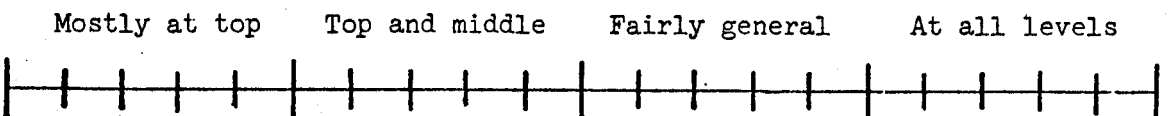
3. Are subordinates' ideas sought and used, if worthy?



4. Is predominant use made of 1 fear, 2 threats, 3 punishment, 4 rewards, 5 involvement?



5. Where is responsibility felt for achieving the organization's goals?



¹From THE HUMAN ORGANIZATION: ITS MANAGEMENT AND VALUE by .Rensis Likert. Copyright (c) 1967 by McGraw-Hill, Inc. By permission of McGraw-Hill Book Company. No further reproduction or distribution authorized without permission of McGraw-Hill, pp. 197-211.

6. How much communication is aimed at achieving the organization's objectives?

Very little Little Quite a bit A great deal



7. What is the direction of information flow?

Downward Mostly downward Down and up Down, up, and sideways



8. How is downward communication accepted?

With suspicion Possibly with suspicion With caution With an open mind



9. How accurate is upward communication?

Often wrong Censored for the boss Limited accuracy Accurate



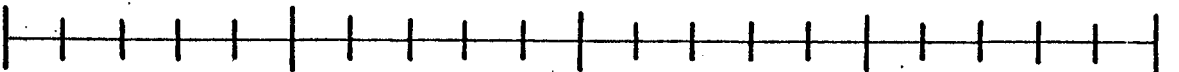
10. How well do superiors know problems faced by subordinates?

Know little Some knowledge Quite well Very well



11. At what level are decisions formally made?

Mostly at top Policy at top, some delegation Broad policy at top, more delegation Throughout but well integrated



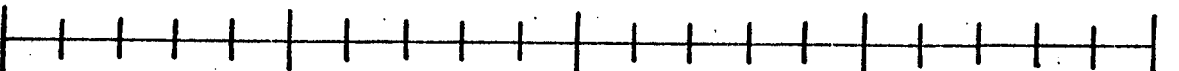
12. What is the source of technical knowledge used in decision making?

Top management Upper and middle To a certain extent, throughout To a great extent, throughout



13. What is the source of managerial knowledge used in decision making?

Top management Upper and middle To a certain extent, throughout To a great extent, throughout



14. Are subordinates involved in decisions related to their work?

Not at all

Occasionally
consulted

Generally
consulted

Fully involved



15. What does decision-making process contribute to motivation?

Nothing, often
weakens it

Relatively
little

Some
contribution

Substantial
contribution



16. How are the organization's goals established?

Orders issued

Orders, some
comment invited

After discus-
sion, by orders

By group action
(except in crisis)



17. How much covert resistance to goals is present?

Strong
resistance

Moderate
resistance

Some resistance
at times

Little or none



18. How concentrated are review and control functions?

Highly at top

Relatively
highly at top

Moderate delega-
tion to lower
levels

Quite widely
shared



19. Is there an informal organization resisting the formal one (the organization chart)?

Yes

Usually

Sometimes

No - same goals
as formal



20. What are cost, performance, and other control data used for?

Policing,
punishment

Reward and
punishment

Reward, some
self-guidance

Self-guidance,
problem solving



* * * * *

PART II

POSITION ORIENTATION²

This part of the questionnaire contains questions about your job at the Manned Spacecraft Center. A short explanation is provided for each specific area that the questions are related to.

* * * * *

The items that follow have to do with how clear you are about the expectations your supervisor has toward your job performance. Please check the appropriate blank that corresponds to your situation.

1. As far as you know, does your immediate supervisor usually let you know when he expects or wants something from you, or does he often keep these things to himself?
☐ a. Always lets me know
☐ b. Usually lets me know
☐ c. Sometimes does, sometimes doesn't
☐ d. Usually does not let me know
☐ e. Never lets me know
2. Do you usually feel that you know how satisfied your immediate supervisor is with what you do?
☐ a. Always know where I stand
☐ b. Usually know
☐ c. Sometimes, and sometimes not
☐ d. Often somewhat in the dark
☐ e. Usually don't know where I stand
3. Do you feel you are always as clear as you would like to be about what you have to do on this job?
☐ a. Yes
☐ b. No
4. Which of the following alternatives best represents how clear you are?
☐ a. I am very clear
☐ b. Quite clear on most things
☐ c. Fairly clear
☐ d. Not too clear
☐ e. I am not at all clear

[Page 31]

²Adopted with kind permission from Robert L. Kahn, et al., Organizational Stress: Studies in Role Conflict and Ambiguity (New York: John Wiley and Sons, Inc., 1964), pp. 415-16, 424-25, 428-29.

5. How clear are you about the limits of your authority in your present position?

- _____ a. I am very clear
- _____ b. Quite clear on most things
- _____ c. Fairly clear
- _____ d. Not too clear
- _____ e. I am not at all clear

* * * * *

All of us occasionally feel bothered by certain kinds of things in our work. The following list contains items that sometimes bother people. Using the scale provided, draw a circle around one of the five numbers (1 2 3 4 5) to show how frequently you feel bothered by each of these items.

- 1 = Never
- 2 = Rarely
- 3 = Sometime
- 4 = Rather often
- 5 = Nearly all the time

- | | | | | | |
|---|---|---|---|---|---|
| 1. Feeling that you have too little authority to carry out the responsibilities assigned to you | 1 | 2 | 3 | 4 | 5 |
| 2. Being unclear on just what the scope and responsibilities of your job are | 1 | 2 | 3 | 4 | 5 |
| 3. Not knowing what opportunities for advancement or promotion exist for you | 1 | 2 | 3 | 4 | 5 |
| 4. Feeling that you have too heavy a work load, one that you can't possibly finish during an ordinary workday | 1 | 2 | 3 | 4 | 5 |
| 5. Thinking that you'll not be able to satisfy the conflicting demands of various people over you | 1 | 2 | 3 | 4 | 5 |
| 6. Feeling that you're not fully qualified to handle your job | 1 | 2 | 3 | 4 | 5 |
| 7. Not knowing what your supervisor thinks of you, how he evaluates your performance | 1 | 2 | 3 | 4 | 5 |
| 8. The fact that you can't get information needed to carry out your job | 1 | 2 | 3 | 4 | 5 |
| 9. Having to decide things that affect the lives of individuals, people that you know | 1 | 2 | 3 | 4 | 5 |
| 10. Feeling that you may not be liked and accepted by the people you work with | 1 | 2 | 3 | 4 | 5 |

1 = Never
 2 = Rarely
 3 = Sometime
 4 = Rather often
 5 = Nearly all the time

- | | | | | | |
|--|---|---|---|---|---|
| 11. Feeling unable to influence your immediate supervisor's decisions and actions that affect you | 1 | 2 | 3 | 4 | 5 |
| 12. Feeling that your progress on the job is not what it should be or could be | 1 | 2 | 3 | 4 | 5 |
| 13. Thinking that someone else may get the job above you, the one you are directly in line for | 1 | 2 | 3 | 4 | 5 |
| 14. Feeling that you have too much responsibility and authority delegated to you by your superiors | 1 | 2 | 3 | 4 | 5 |

* * * * *

The following questions concern the nature of your work at the Manned Spacecraft Center. Please check the blank applicable to each question.

1. Is there some other work, either here or outside the Manned Spacecraft Center, which you would like better than what you are now doing?
 _____ I would rather have some other job
 _____ I would rather have my present job

2. Not counting all the other things that make your particular job good or bad, how do you like the kind of work that you do?
 _____ I dislike it very much; would prefer almost any other kind of work
 _____ I don't like it very much; would much prefer some other kind of work
 _____ It's all right, but there are other kinds of work I like better
 _____ I like it very much, but there are other kinds of work I like just as much
 _____ It's exactly the kind of work I like best

3. How do you feel about the progress you have made at the Manned Spacecraft Center?
 _____ I have made little or no progress
 _____ I have made some progress, but it should have been much better
 _____ I have made quite a lot of progress, but it should have been better
 _____ I have made a great deal of progress.

4. How much does your job give you a chance to do the things you are best at?

_____ No chance at all

_____ Very little chance

_____ Some chance

_____ Very good chance

5. How do you like working for the Manned Spacecraft Center?

_____ It's not a very good place to work

_____ It's all right, but there are many things that should be changed

_____ It's a fairly good place, but there are a few things that should be changed

_____ It's a good place, but there are a few things that should be changed

_____ It's a very good place--wouldn't change anything

6. Would you advise a friend to come and work for the Manned Spacecraft Center?

_____ I would not advise a friend to come and work for the Manned Spacecraft Center

_____ I would advise a friend to come and work for the Manned Spacecraft Center

7. If you had a chance to do the same kind of work for the same pay, but in another organization, would you stay here?

_____ I would prefer to go to the other organization

_____ I would stay at the Manned Spacecraft Center

* * * * *

PART III

BACKGROUND AND EXPERIENCE

1. If the code in the upper right hand corner of this questionnaire is incorrect, would you please provide your mailing address code? _____
2. Please check the functional category that best describes what you do the majority of your time.

- _____ 1. Research. Systematic, critical, intensive investigation directed toward the development of new or fuller scientific knowledge of the subject studied. It may be with or without reference to a specific application. The work involves theoretical, taxonomic, and experimental investigations or simulation of experiments and conditions.
- _____ 2. Research and Development Contract Monitorship. The administration and monitoring of research contracts and hardware contracts and/or support service contracts.
- _____ 3. Development. Systematic application of scientific knowledge directed toward the creation of new or substantially improved equipment, materials, instrumentation, devices, systems, mathematical models, processes, techniques, and procedures which will perform a useful function or be suitable for a particular duty.

Development, like research, advances the state of the art, but it is further characterized by the creation of specific end-items in the form of equipment or equipment systems ("hardware" development) and/or methodologies, mathematical models, procedures and techniques ("software" development).

- _____ 4. Test and Evaluation. The testing of equipment, materials, devices, components, systems and methodologies under controlled conditions and the systematic evaluation of test data to determine the degree of compliance of the test item with predetermined criteria and requirements. This work is characterized by the development and application of test plans to be carried out in-house or under contract or grant utilizing one or more of the following kinds of tests: physical measurement techniques; controlled laboratory, shop, and field (demonstration) trials; and simulated environmental techniques.
- _____ 5. Design. The planning, synthesis, and portrayal for purposes of fabrication or construction of structures, equipment, materials, facilities, devices, and processes which will perform a useful function or be suitable for a certain duty.

For present purposes, design in a research and development organization is the application of the known state of the art in the form of standard guidelines and references to prepare the detailed working plans and data required for fabrication, assembly, and production.

- _____ 6. Data Collection, Processing and Analysis. The collection, processing, and analysis of general purpose scientific data describing natural and social phenomena. General purpose scientific data include newly gathered statistics, observations, instrument readings, measurements, specimens and other facts obtained from such activities as statistical and field surveys, exploration, laboratory analyses, photogrammetry, and compilations of operating records for use by others.

Excluded from this category are collection and analysis of data only for research and development projects and internal operating or administrative purposes such as policy formulation or planning.

- _____ 7. Quality Control Engineering. The preparation and determination of mandatory and/or voluntary standards including rules, regulations, and codes.

The work involves the development of performance criteria, test and inspection methods, and data for the application of the standards to technological products and services.

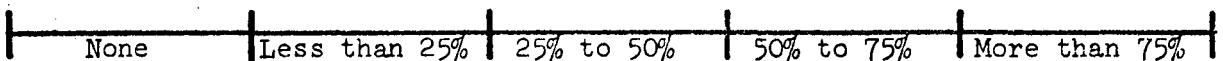
- _____ 8. Planning. The study and projection of present and future needs and the formulation of alternative policies and ways of meeting these needs for the utilization of: Land; natural, social, industrial, material and manpower resources; physical facilities; and social and economic services and programs.

This category includes physical, economic, and social planning for land population centers and mission, policy, and program planning.

- _____ 9. Mission Operations. Concerned with manning consoles in Mission Control Center, evaluating data from spacecraft and giving directions to astronauts.

- _____ 10. Other, specify.

3. Approximately how much time do you spend on evaluation and direction of the contractor? Place an "X" between the appropriate guideline.



4. If it were possible to make a change in your present functional category, would you be interested? _____ Yes _____ No. If yes, which functional category would you select? Please refer to question number 2.
-

5. If it were possible to make a change in your present division or office at MSC, would you be interested? _____ Yes _____ No. If yes, which division or office would you select.
-

6. Sex: _____ Male _____ Female

7. What is your present GS grade? _____

8. What was your GS grade at the time you began working at MSC? _____

9. How long have you worked for MSC? Year(s) _____ Months _____

10. How many different positions have you held at MSC? Place an "X" between the appropriate guideline.

| 1 | 2 | 3 | 4 | 5 | More than 5 |

11. How long have you worked in your present position? Year(s) _____ Months _____

12. How long have you been working under your present supervisor?
Year(s) _____ Months _____

13. How many people work under your immediate supervisor? _____

14. How much experience in work related to your profession do you have in organizations other than MSC? (Do not include military service)
Year(s) _____ Months _____

15. What was the highest education level you completed? (Check one)

Bachelor's degree _____

Bachelor's degree plus some graduate work _____

Master's degree _____

Master's degree plus some graduate work _____

Other kinds of schooling, specify _____

16. When did you graduate? Year _____ At what age? _____

17. What was your major in college? _____
In graduate school? _____

18. How many special activities have you taken part in during the last year? (This includes acting as supervisor, taking part in committee studies or any other activities that did not involve the majority of the people in your section.) Please distinguish between activities undertaken within your section and those which were outside your section.

A. Activities within the section. Place an "X" between the appropriate guideline.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Over 10 |

B. Activities outside the section. Place an "X" between the appropriate guideline.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Over 10 |

19. How many of the following have you had during your employment at MSC? Fill each space.

	<u>Approximate number</u>
Number of papers published in professional journals or presented at conferences which were external to NASA	_____
Number of patents or patent applications	_____
Number of working papers	_____
Number of NASA reports	_____
Quality step increase	_____
Sustained superior performance award	_____
Invention award	_____

20. How useful do you feel the work is that you do? Place an "X" between the appropriate guideline.

| None | A little | Some | Quite a bit | Very much |

21. What is your date of birth? _____

22. What is your current marital status? Place an "X" between the appropriate guideline.

| Single | Married | Widowed | Divorced | Separated |

* * * * *

Thank you very much for your cooperation in filling out this rather lengthy questionnaire. Your help is deeply appreciated.

Richard Hamilton

APPENDIX B

FUNCTIONAL AMBIGUITY INTERVIEW

1. What is your job title?
2. Has the lack of clarity associated with your job hindered your performance? Why?
3. Would it be better if more of the duties, responsibilities and details associated with your job were in writing? Why?
4. How much direction and control do you receive in the performance of your job? Is it functional or detrimental to your performance?
5. In connection with your work how do you solve problems that arise?
6. What methods have been used to cope with areas of uncertainty that arise in connection with your job?
7. What statement best describes an aspect of your job situation? (The interviewee reads both of these statements and selects the best one.)
 - a. Formal procedures have been established so that uncertainties concerning my job can be resolved by established guidelines for decision-making.
 - b. There is an informal understanding between my colleagues and my supervisor that some uncertainties concerning my job can be resolved by verbal agreements.

APPENDIX C

AGE PROFILE FOR EACH DIRECTORATE

Age	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
21 - 25	14	32	17	31	5	14	9	29
26 - 30	24	54	23	43	15	42	17	54
31 - 35	4	10	8	15	13	36	5	16
36 - 40	2	04	5	09	1	03	1	01
41 - 45			1	02	2	05		
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

SALARY GRADE PROFILE FOR EACH DIRECTORATE

Present Salary Grade	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
7	5	11	9	17			4	13
9	6	14	14	26	2	06	7	22
11	14	32	13	24	12	33	12	37
12	19	43	18	33	22	61	9	28
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

LENGTH OF SERVICE PROFILE FOR EACH DIRECTORATE

Length of Service at the Manned Spacecraft Center	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
27 Less than 1 year							1	03
1 year	8	18	13	20	9	25	10	31
2 years	4	09	19	35	1	03	8	25
3 years	10	23	5	09	5	14	6	19
4 years	8	18	8	15	5	14	7	22
5 years	10	23	7	17	8	22		
6 years	4	09	1	02	7	19		
More than 6 years			1	02	1	03		
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

LENGTH OF SERVICE IN PRESENT POSITION PROFILE FOR EACH DIRECTORATE

Length of Service in Present Position	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Less than 1 year			3	06	4	11	1	03
1 year	18	41	24	44	17	48	15	48
2 years	7	16	13	24	4	11	11	34
3 years	9	20	3	06	4	11	3	09
4 years	7	16	4	08			2	06
5 years	2	05	6	11	6	16		
6 years	1	02	1	01	1	03		
More than 6 years								
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

LENGTH OF SERVICE WITH PRESENT SUPERVISOR PROFILE FOR EACH DIRECTORATE

Length of Service with Present Supervisor	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Less than 1 year	3	07	3	05	5	14		
1 year	18	41	36	67	18	50	19	60
2 years	7	16	10	19	5	14	8	25
3 years	9	20	4	07	3	08	4	12
4 years	6	14					1	03
5 years	1	02	1	02	5	14		
6 years								
More than 6 years								
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

FUNCTIONS PERFORMED PROFILE FOR EACH DIRECTORATE

Functions Performed	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Research	4	10	1	02	8	22		
Contract Monitor- ship	4	10	2	04	8	22	3	09
Development	19	43	14	26	6	17	12	38
Test and Evalua- tion	8	18	5	09	3	08	4	12
Design	1	02	3	06	1	03	2	06
Data Analysis	2	04	5	09				
Quality Control								
Planning	1	02	10	18	2	06	1	03
Mission Operations			8	15			5	16
Other	5	11	6	11	8	22	5	16
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

EDUCATIONAL LEVEL PROFILE FOR EACH DIRECTORATE

Educational Level	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Bachelor's degree	20	45	27	50	11	30	15	47
Bachelor's plus some graduate work	14	32	22	41	14	39	12	38
Master's degree	3	07	2	04	6	17	2	06
Master's plus some graduate work	7	16	3	05	3	08	3	09
Other					2	06		
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Continued

MAJOR IN COLLEGE PROFILE FOR EACH DIRECTORATE

Major in College	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Agriculture					1	03		
Bacteriology	1	02						
Chemistry	1	02	1	02				
Geology					1	03		
Mathematics	10	23	21	39	6	17	4	12
Physics	2	05	7	13	17	47	7	22
Other							2	06
Engineering	30	68	25	46	11	30	19	60
TOTAL	44	100	54	100	36	100	32	100

APPENDIX C - Concluded

MAJOR IN GRADUATE SCHOOL PROFILE FOR EACH DIRECTORATE

Major in Graduate School	Engineering and Development N=44		Flight Operations N=54		Science and Applications N=36		Flight Crew N=32	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Architecture	1	04						
Agriculture					1	04		
Psychology	1	04						
Mathematics	6	24	11	44			2	13
Physics	1	04	3	12	12	50	6	40
Other					5	21		
Engineering	15	60	8	32	5	21	6	40
Business			3	12	1	04	1	07
Education	1	04						
TOTAL	25	100	25	100	24	100	15	100

APPENDIX D

DIRECTORATE PROFILE OF CORRELATIONS BETWEEN JOB AMBIGUITY AND ITS REACTIONS

Reactions	Engineering and Development	Flight Operations	Science and Applications	Flight Crew Operations
Tension				
r_s value	.68	.73	.63	.66
*t value	5.98	7.701	4.78	4.84
Job Satisfac- tion				
r_s value	- .36	- .57	- .32	- .51
*t value	-2.51	-5.00	-1.99	-3.27

*In all cases the t value was enlarged enough to equal or exceed a 5% level of significance. The t value is a mathematically derived factor which is used to test the significance of a measure of association between two variables. In terms of statistical probability, at a 5% significance level, we are confident that 95 times out of 100 we can expect to find measures of association from a population of non-supervisory AST's, and 5 times out of 100 by chance alone. Observations of the t values also indicate the presence of stronger measures of association between job ambiguity and tension. Perhaps, factors such as the job's intrinsic value, the individual's personality needs, management styles, and the professional work group relationships are intervening variables which influence the association between ambiguity and job satisfaction.

SELECTED BIBLIOGRAPHY

- Blau, Peter M., and Scott, W. Richard. Formal Organizations. San Francisco: Chandler Publishing Co., 1962.
- Dalton, Melville. Men Who Manage. New York: John Wiley and Sons, Inc., 1959.
- Kahn, R. L., et al. Organizational Stress: Studies in Role Conflict and Ambiguity. New York: John Wiley and Sons, Inc., 1964.
- Likert, Rensis. The Human Organization. New York: McGraw-Hill, 1967.
- March, James G., and Simon, Herbert A. Organizations. New York: John Wiley and Sons, Inc., 1958.
- Massarik, Fred. Functional Ambiguity and the Cushioning of Organizational Stress. A Research Paper Supported by a Grant of the National Aeronautics and Space Administration, Prepared by the Division of Research, Graduate School of Business Administration. Los Angeles: University of California, 1966.
- Pelz, Donald C., and Andrews, Frank M. Scientists in Organizations. New York: John Wiley and Sons, Inc., 1966.
- Schein, Edgar H. Organizational Psychology. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965.
- Selltiz, Claire, et al. Research Methods in Social Relations. Revised. New York: Holt, Rinehart and Winston, 1964.
- Siegel, Sidney. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill Company, Inc., 1956.